An Historical View of the Human Effectiveness Directorate

For

The DoD Human Factors Engineering Technical Advisory Group

03 Nov 2003

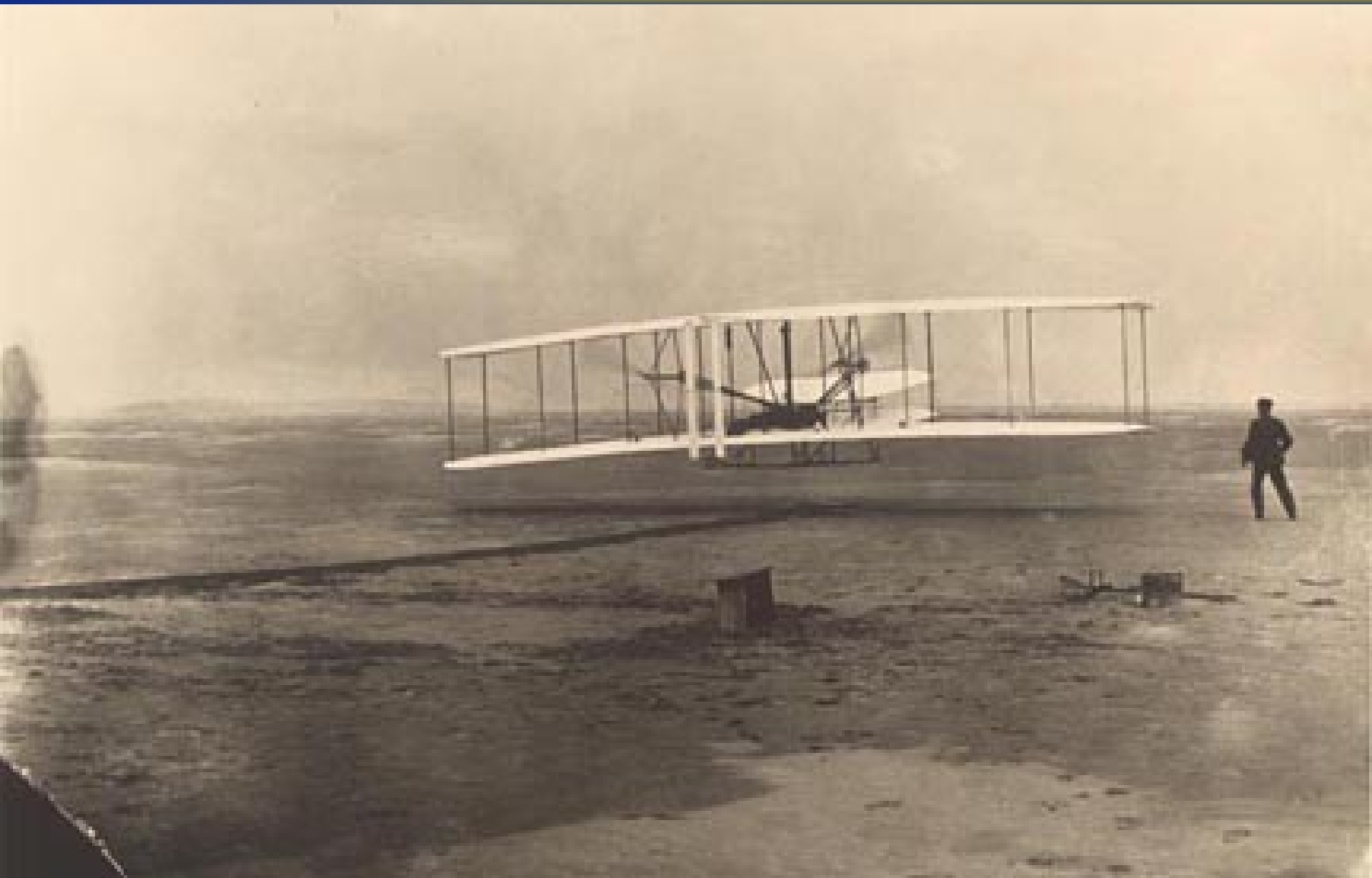
Dr. Henk Ruck, SES

Director

Human Effectiveness Directorate

Air Force Research Laboratory

First Powered Flight, Wright Brothers, Dec 17, 1903



Timeline of Events

- **1917 –** Aeronautical research and development projects at **McCook Field,** Dayton, OH
- **1918 – Airplane Engineering Division** established (center of all aircraft design and development) with five subdivisions, one of which was the **Equipment Branch**
- **1926 –Army Air Corps** formed and the **Materiel Division** was formed at McCook Field
- **1927 – Materiel Division** moved to **Wright Field** with **Equipment Branch** still defined
- **1935 – Capt Armstrong** appointed chief, **Physiological Research Lab** within the Equipment Branch
- **1937 – First official work of the lab – gather hypoxia data**
- **1941 – Army Air Forces** formed

Harry G. Armstrong

Timeline of Events

- **1942 –** The **Physiological Research Lab** was renamed **Aero Medical Research Lab**
- **1945 –** Establishment of **Psychology Branch** and **Paul M. Fitts** was assigned chief
- **1947 – US Air Force** formed
- **1979 –** Renamed **Air Force Medical Research Laboratory**
- **1985 –** Renamed **Harry G. Armstrong Aerospace Medical Research Laboratory**
- **1991 –** Renamed **Crew Systems Directorate** of **Armstrong Laboratory**
- **1997 –** Renamed **Human Effectiveness Directorate** of **Air Force Research Laboratory**

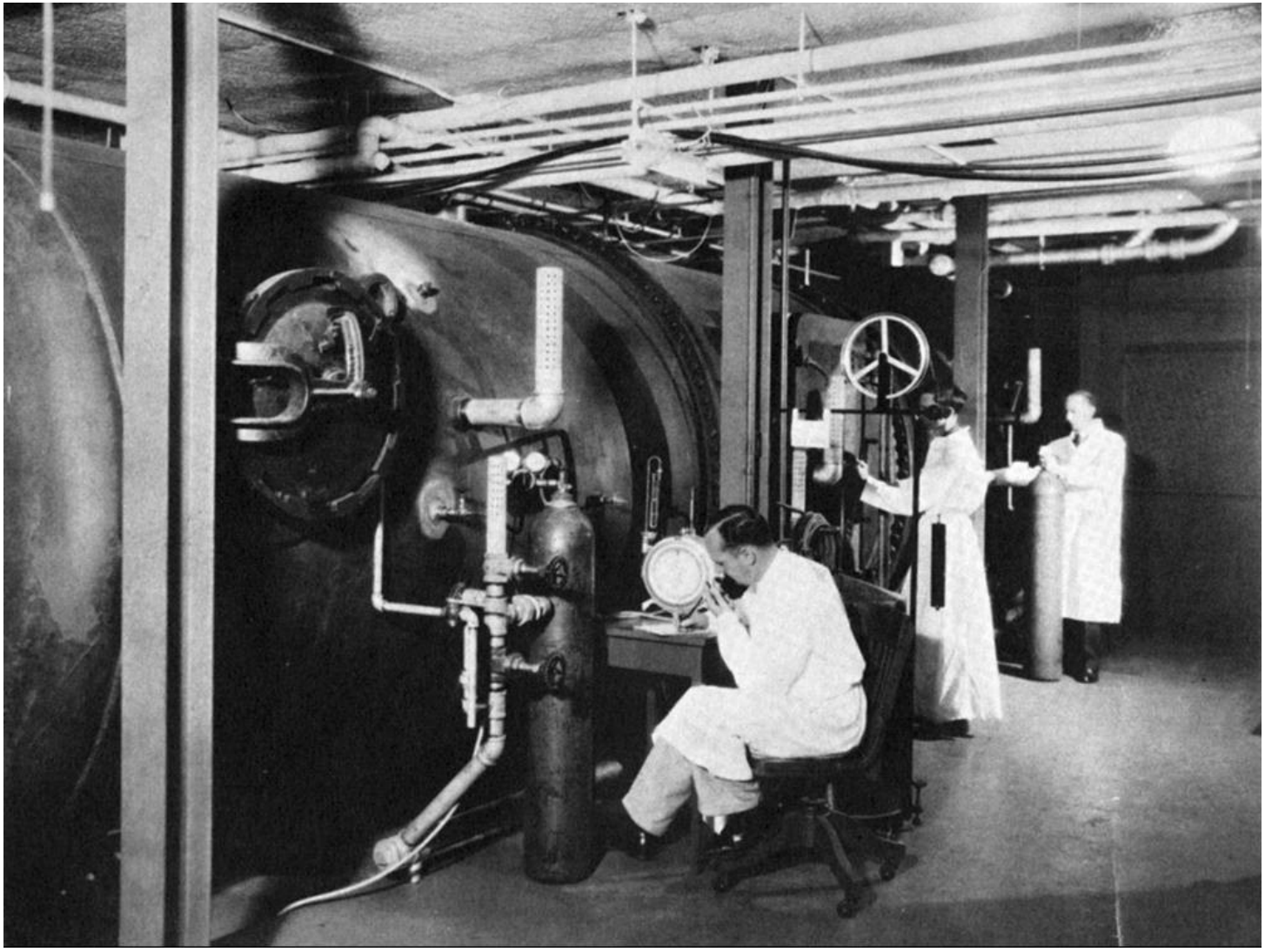
Lt. Col. Paul M. Fitts

Challenging Aeromedical Problems

- 1934-1940 Early Aero Medical Research
  - **Altitude, Gs, and Temperature**
- 1941-1945 The War Years
  - **G-suits, Ejection, and Training**
- 1946-1958 Jet Flight Research
  - **Anthropology and Cockpits**
- 1959-1969 Space Flight Research
  - **Space Environment, Helmet-Mounted Displays**
- 1970-1985 Advanced Flight Research
  - **Communications, Workload**
- 1985-Present
  - **Advanced Cockpits, AOCs, and UAVs**

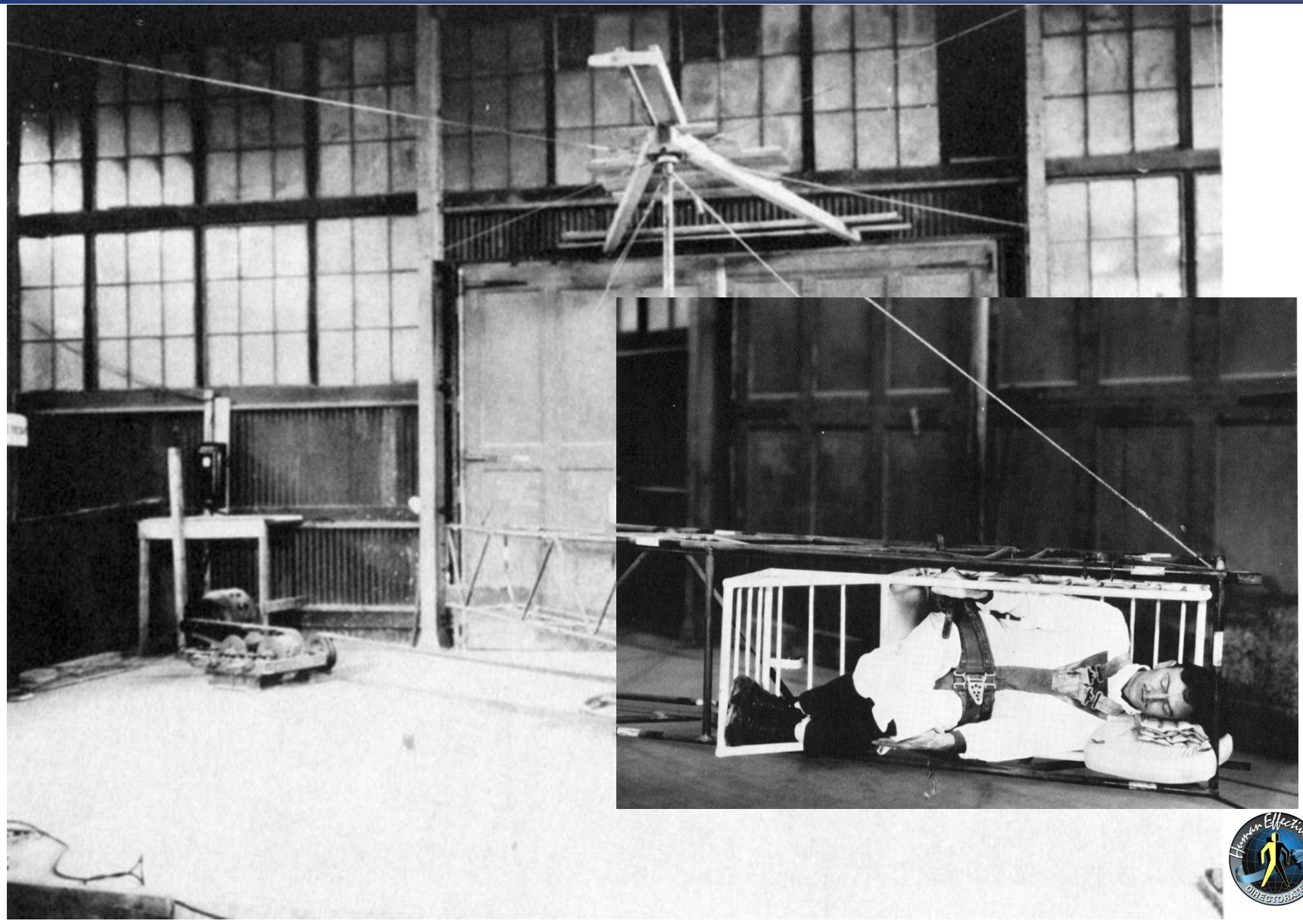
Pressure Suite circa 1934

Altitude Chamber circa 1937



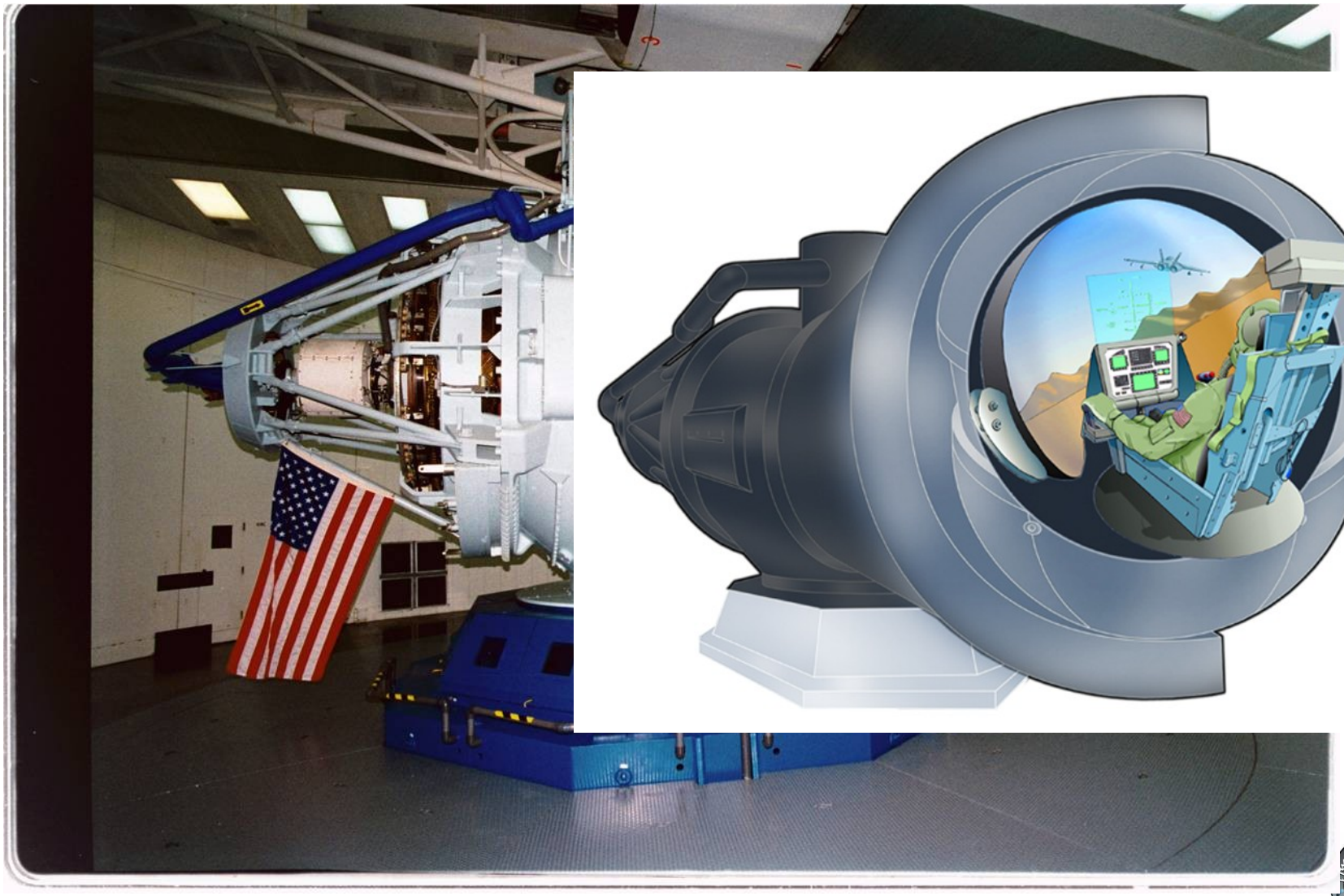
Altitude Chamber Today
Brooks City-Base TX

Centrifuge circa 1936



Centrifuge Today (Brooks)

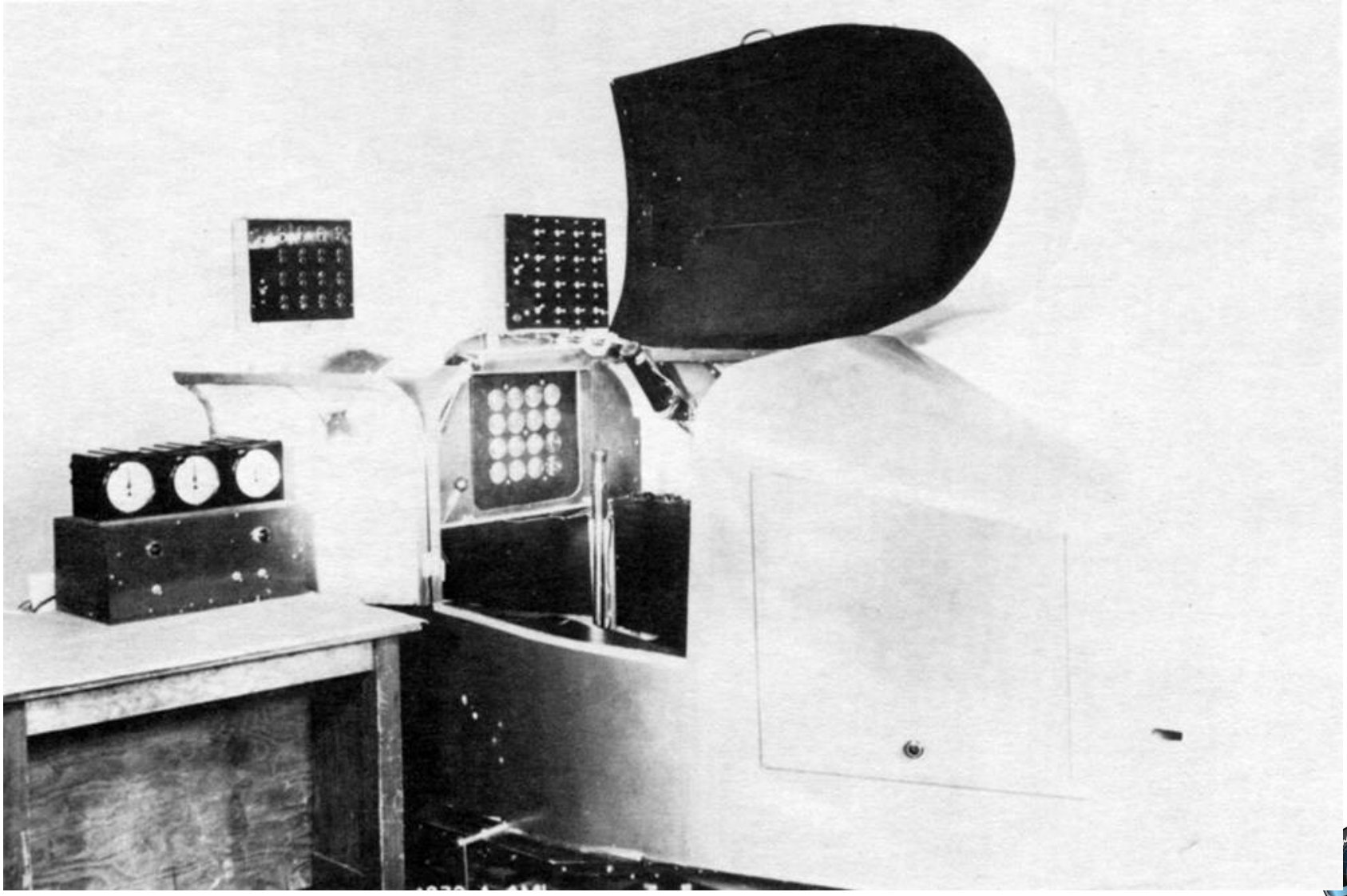
Centrifuge Today (WPAFB)



Anti-G Suit circa 1944

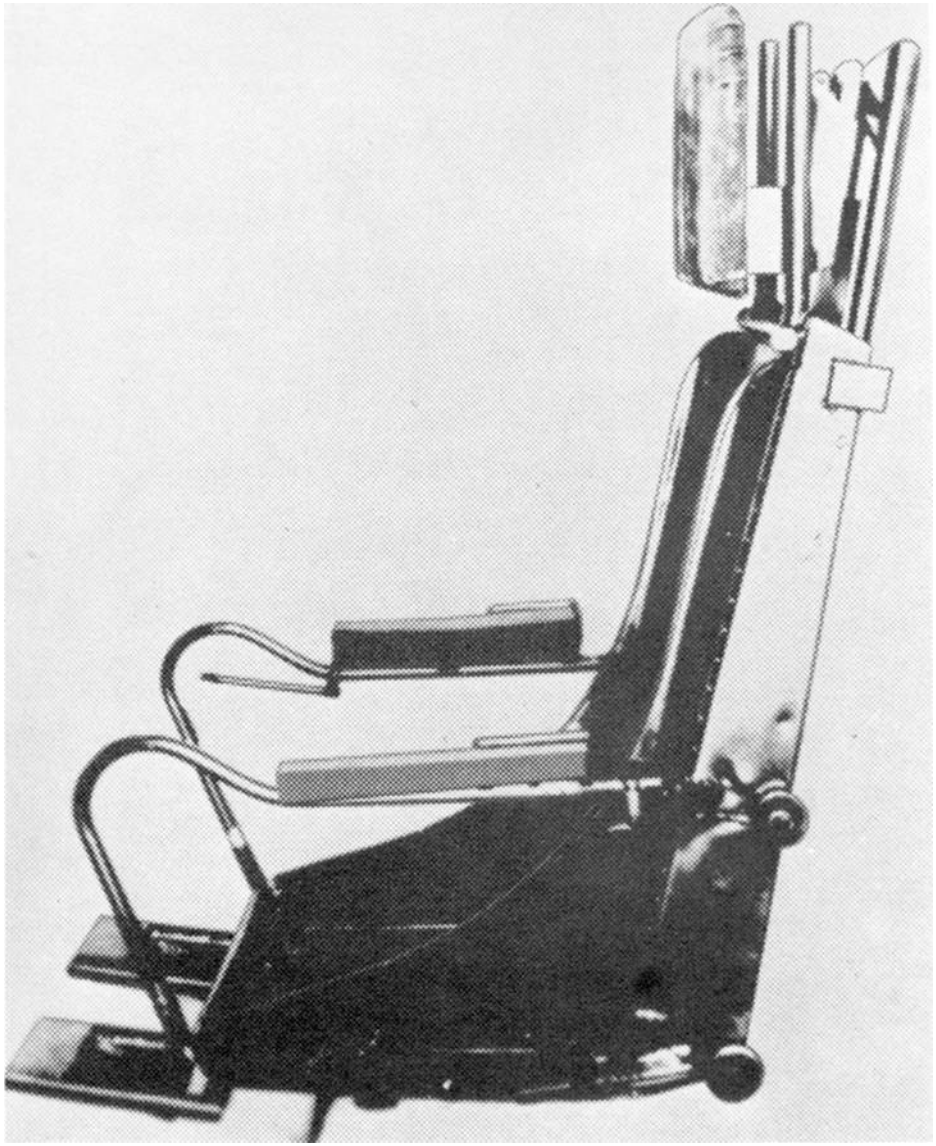
Life Support Equipment Today

Link Training Simulator circa 1945



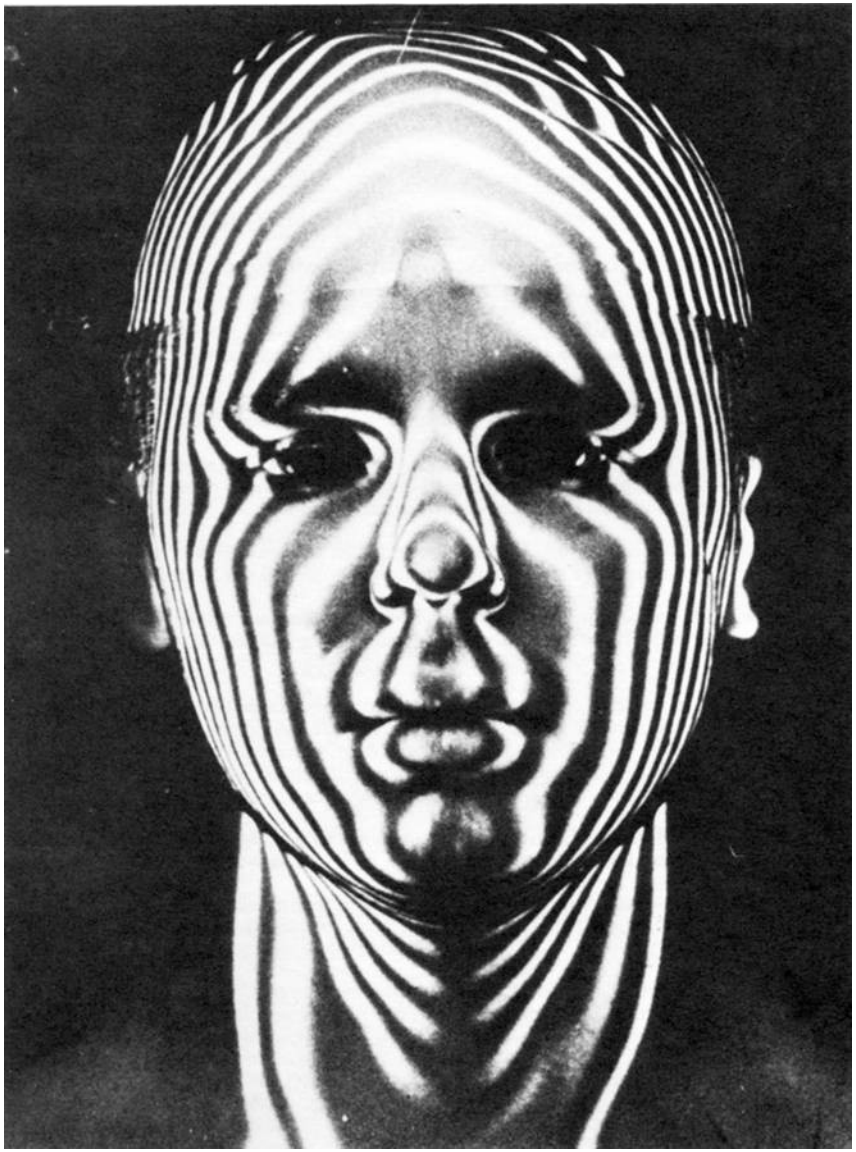
Simulator Today

German Ejection Seat circa 1945

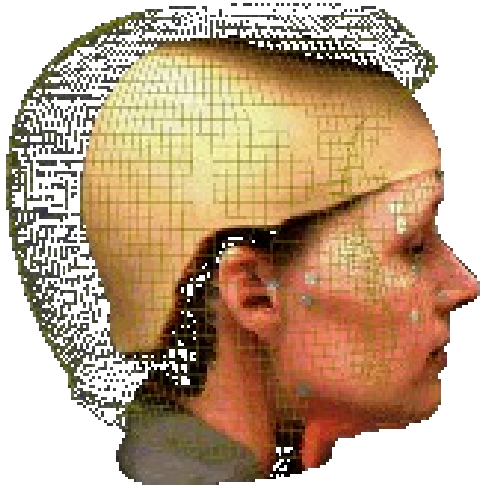


Ejection Demonstrator Today

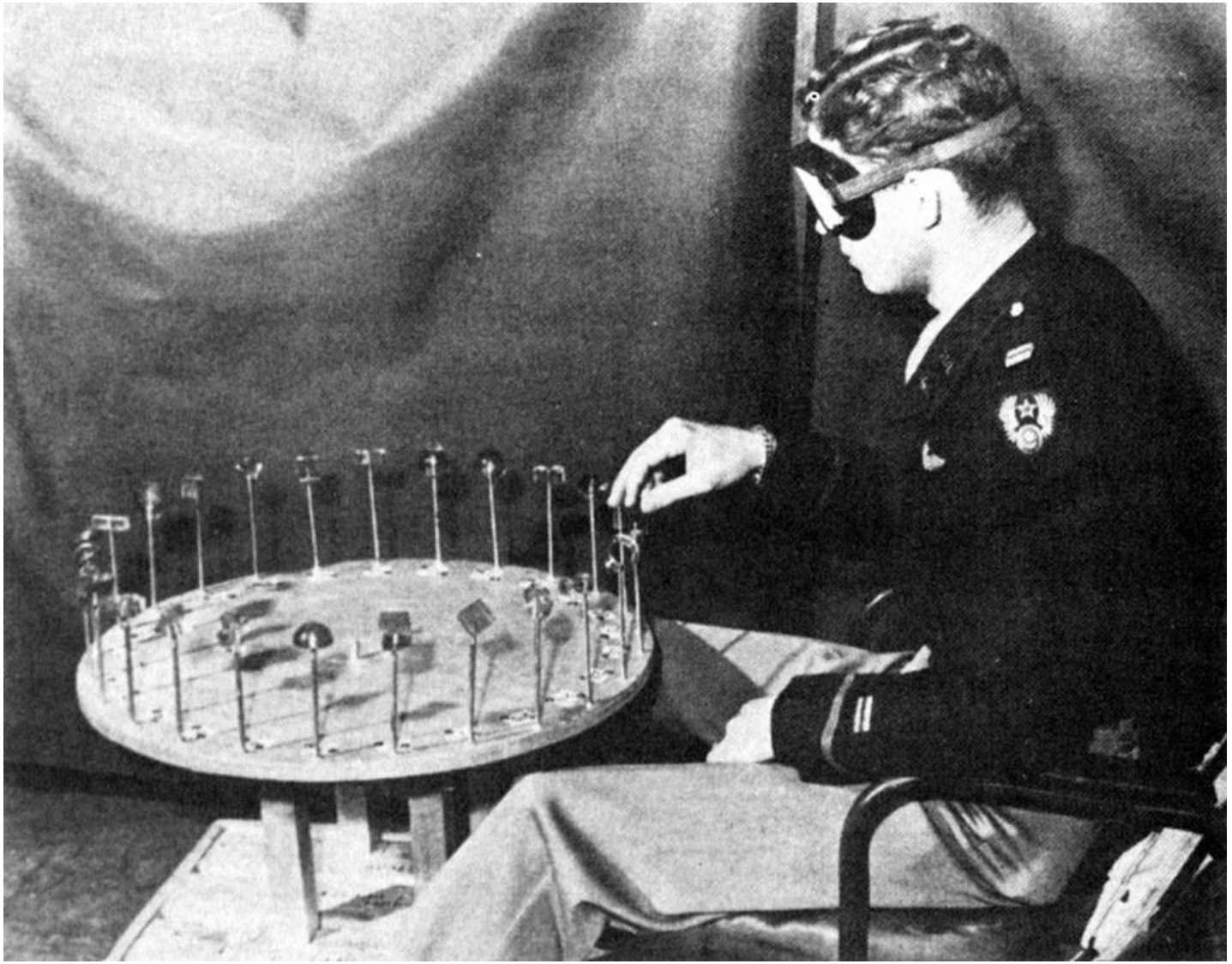
Contour Mapping circa 1946-1958



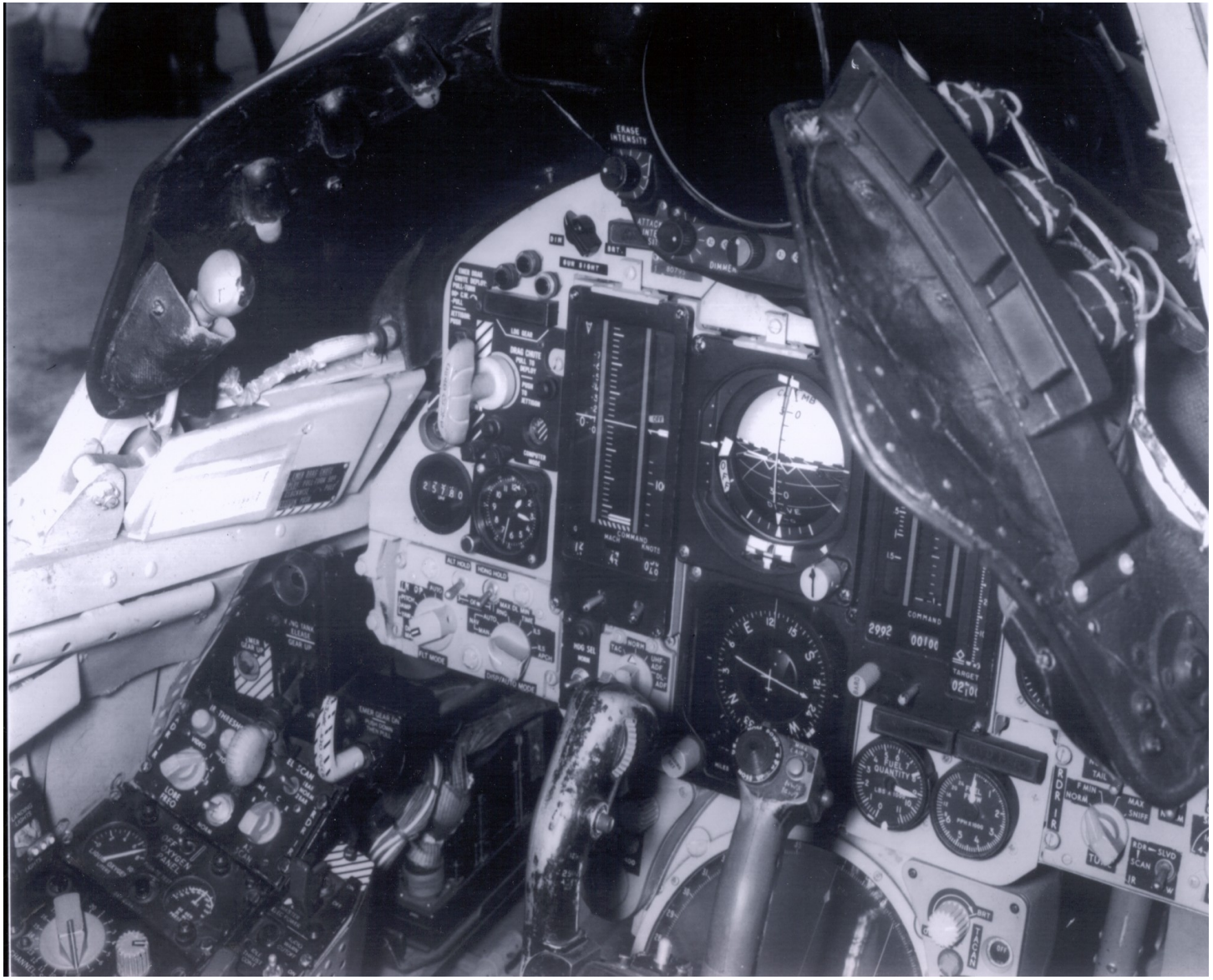
3-D Head Scanner and Whole Body Scanner Today



Coding Aircraft Control Knobs circa 1946



Integrated Flight Instrument System (1955-1958)

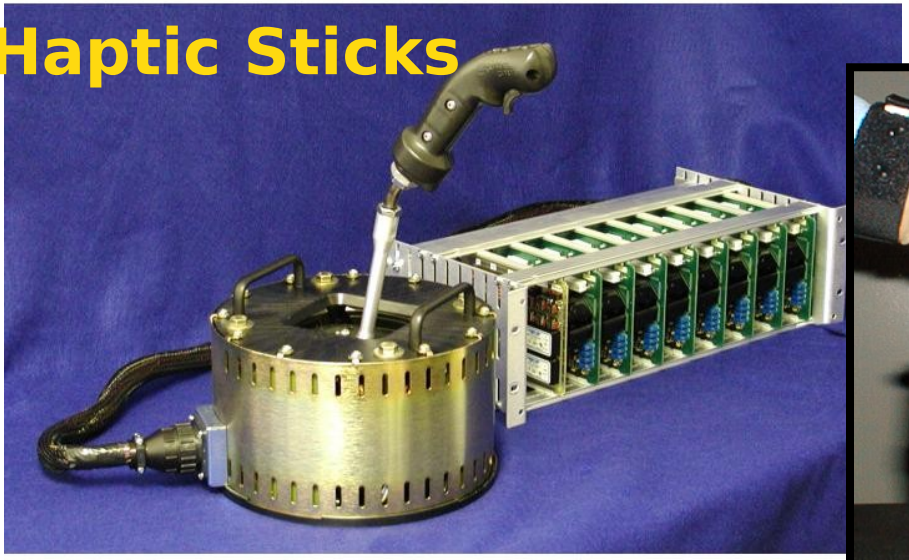


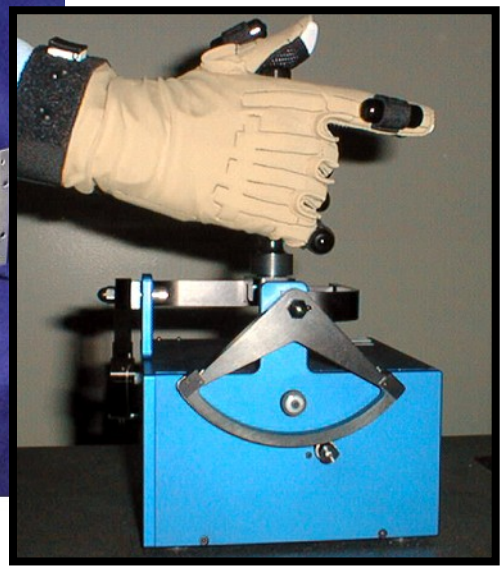
Today's Cockpit Layout (F/A-22 Cockpit)

Tomorrow's Controls

Voice Control

Haptic Sticks





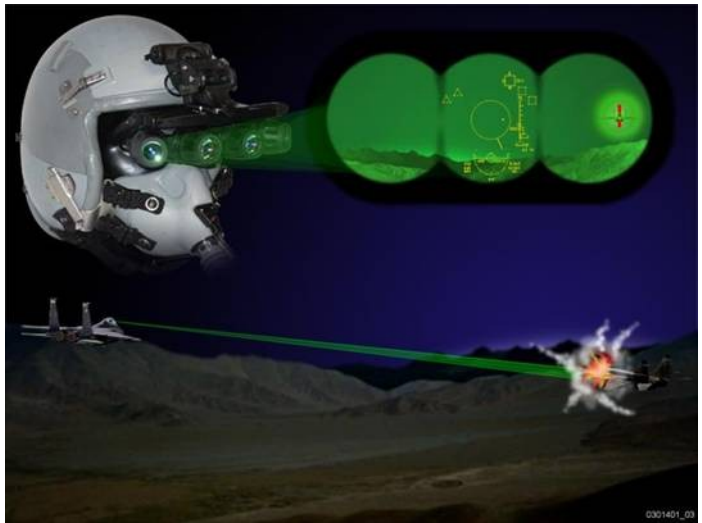
Virtual Environments

UAVS

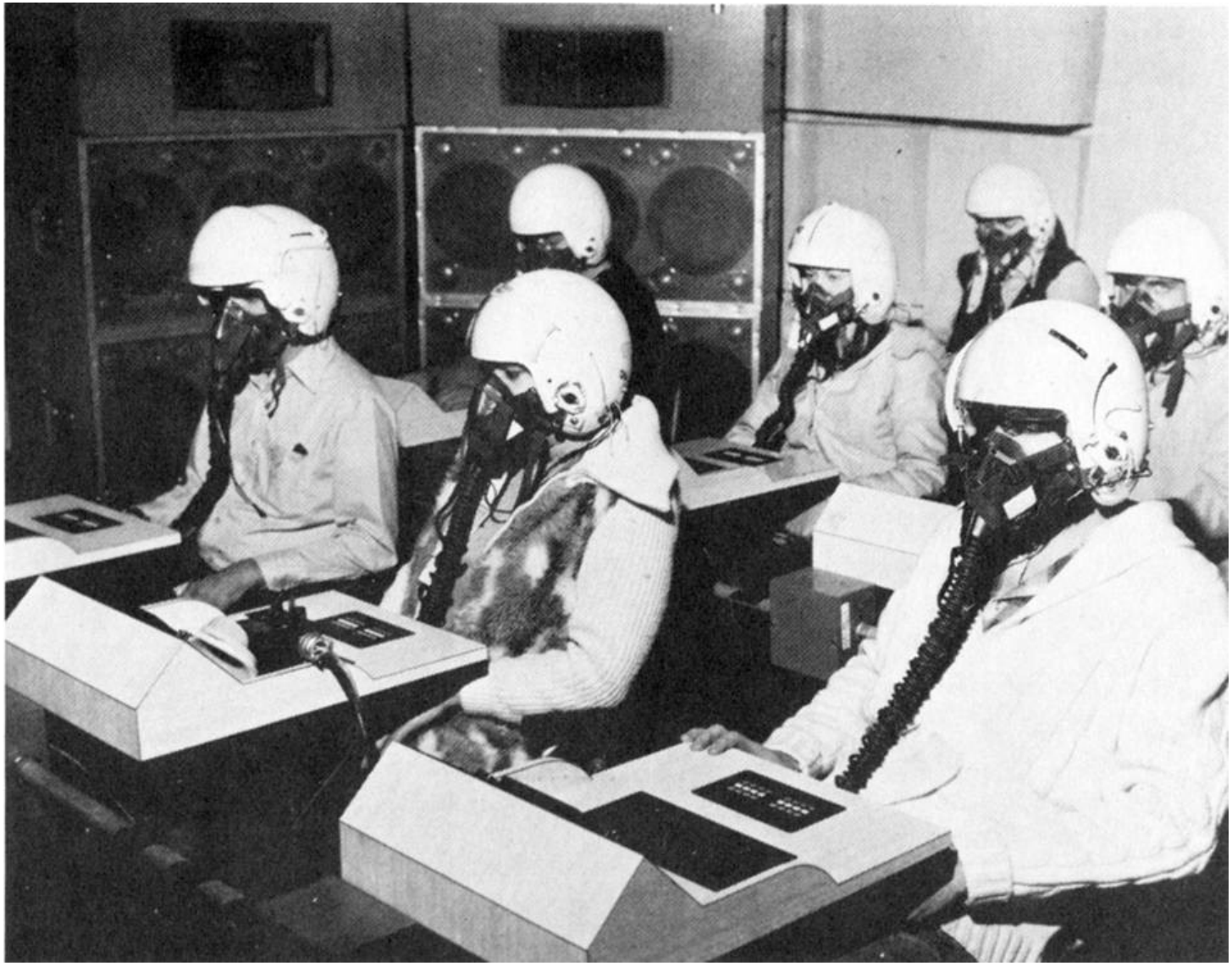
UCAVS

Helmet-Mounted Display circa 1968-1969

Helmet-Mounted Displays and Night-Vision Goggles Today

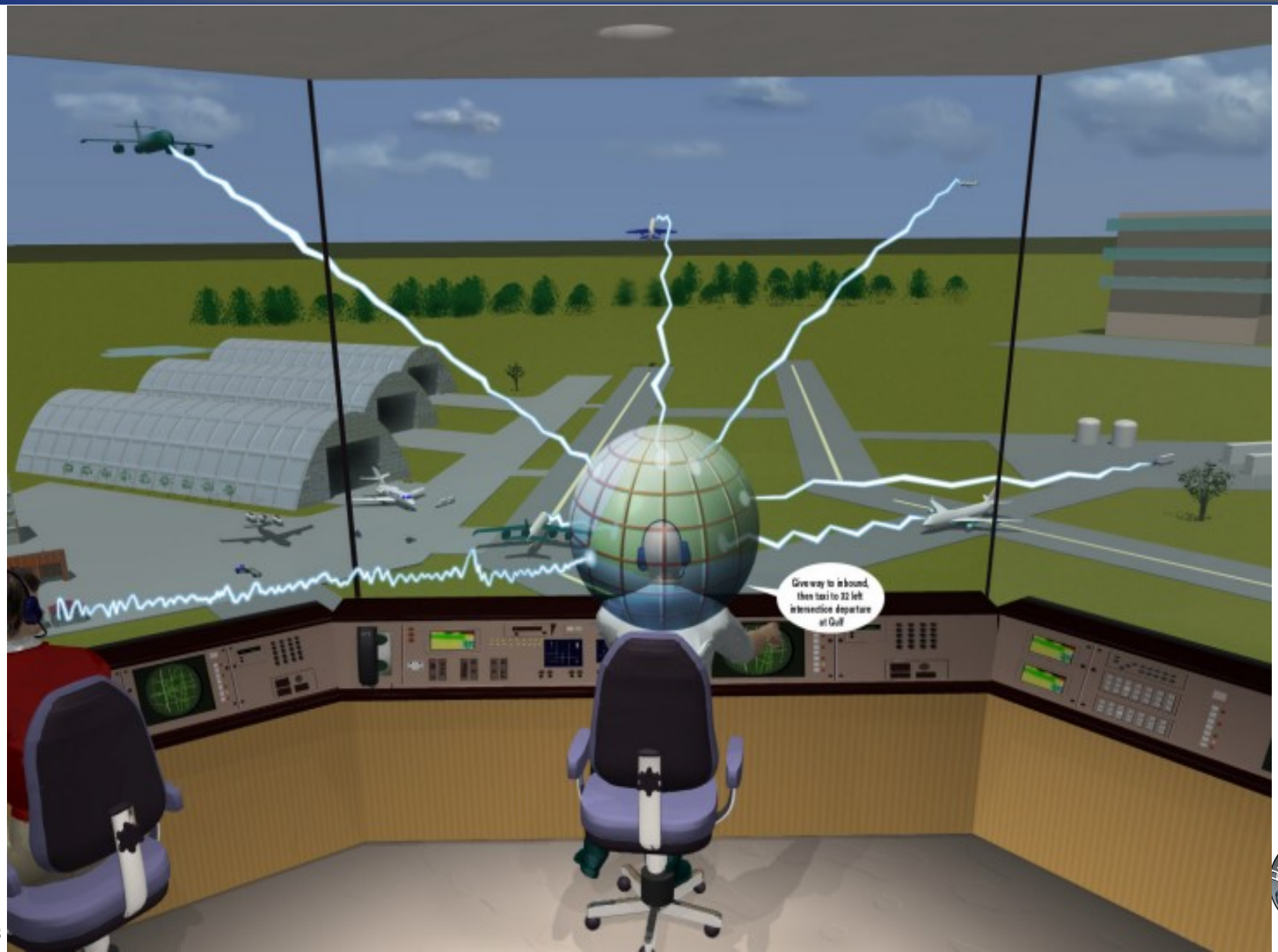


Multiple Operator Experiments in Voice Communications 1970-1984



Multiple Operator Experiments in Voice Communications Today

Communication with 3-D Audio

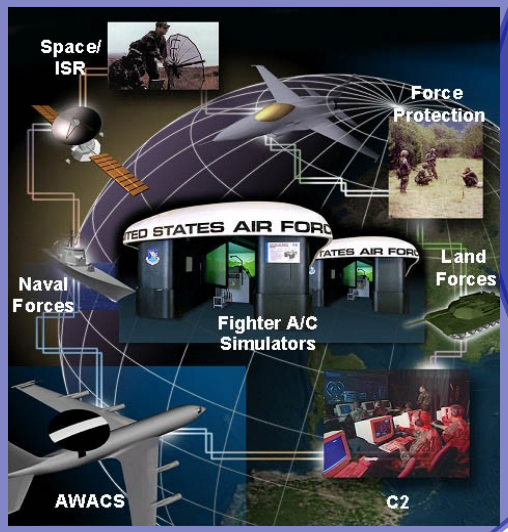


Future Air Operation Center

HE Today and Tomorrow

Capabilities Focused Technologies

Train as We Fight



- Skills Development
- Training & Simulation

Decision Effectiveness

- Information Portrayal
- Decision Making
- Human-System Representation

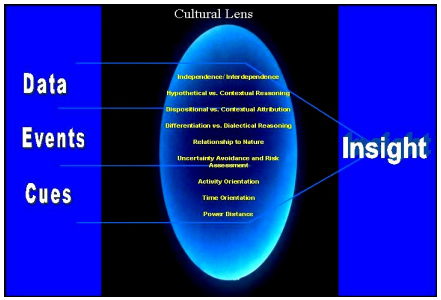
Immunity from Threat

- Directed Energy Bioeffects
- Physical Stressors
- Toxic Hazards

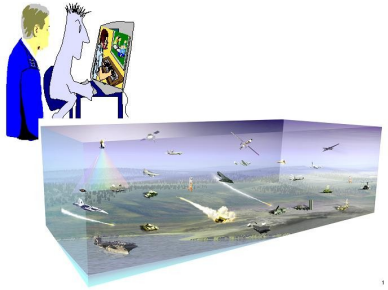
Interconnected Core Technology Areas

Decision Effectiveness Thrust
Core Technology Areas

Human-System Representation



Cultural Lens Modeling



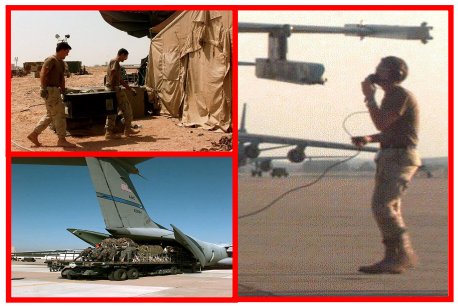
Agent-Based Modeling and Behavioral Representation

Cascading Air Power Effects Simulation

Information Portrayal

Helmet Mounted Display Technologies

3-D Audio for Spatial Cueing



Logistics Control and Information Support

Decision

Warfighter Interfaces for C2 and IW Operations

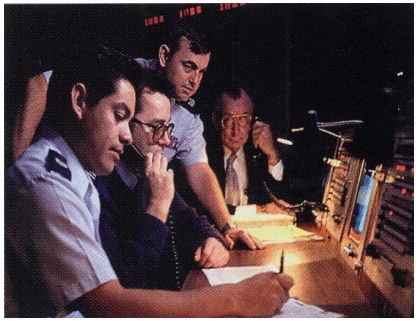
Interfaces for Intelligent Autonomous Air Vehicles

Software Agents for Air Mobility Decisions

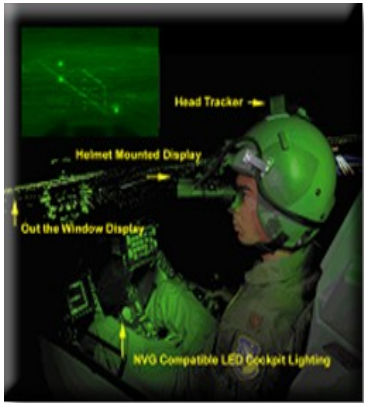
Train as We Fight Thrust
Core Technology Areas

Skills Development

Command & Control Training Research



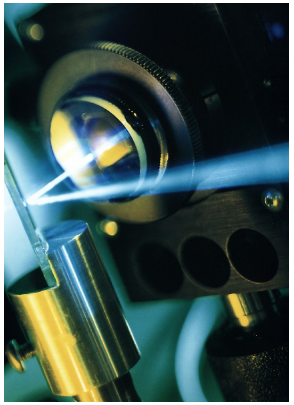
Embedded Monitoring



Training for Night Operations

Training and Simulation

20/20 Immersive Displays



DMT Display Technology Applied Research

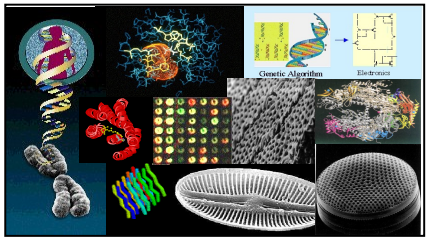
Next Generation Threat System Simulation

Immunity From Threat Thrust
Core Technology Areas

Toxic Hazards

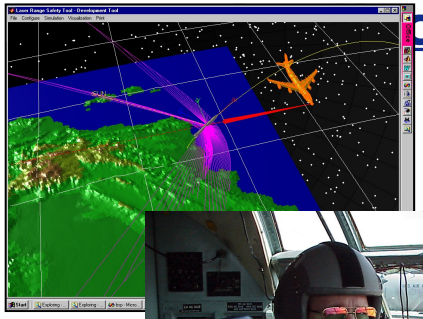
Predictive Toxicology

Counterproliferation



Genomics and Proteomics

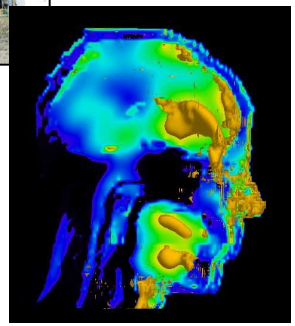
Directed Energy



Laser Safety

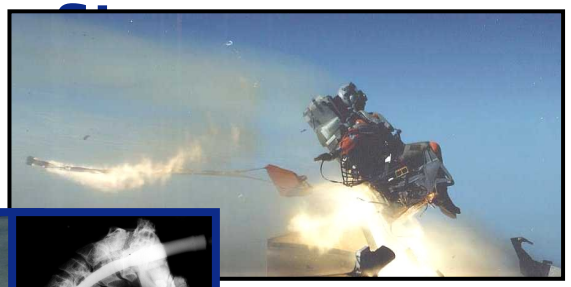
Laser Eye Protection

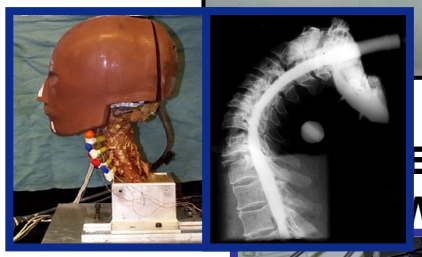
Active Denial Technology



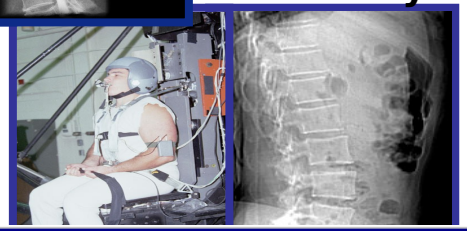
Directed Energy Bioeffects

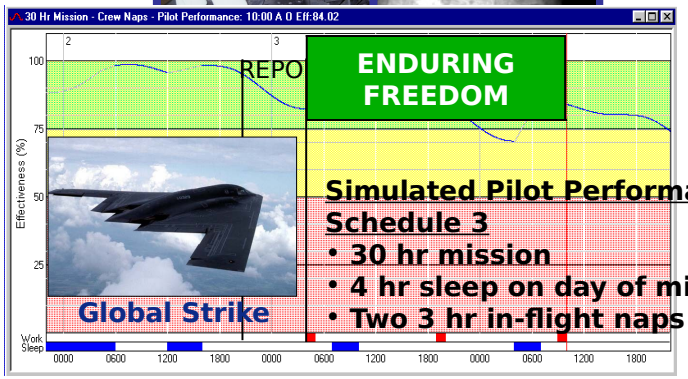
Physical





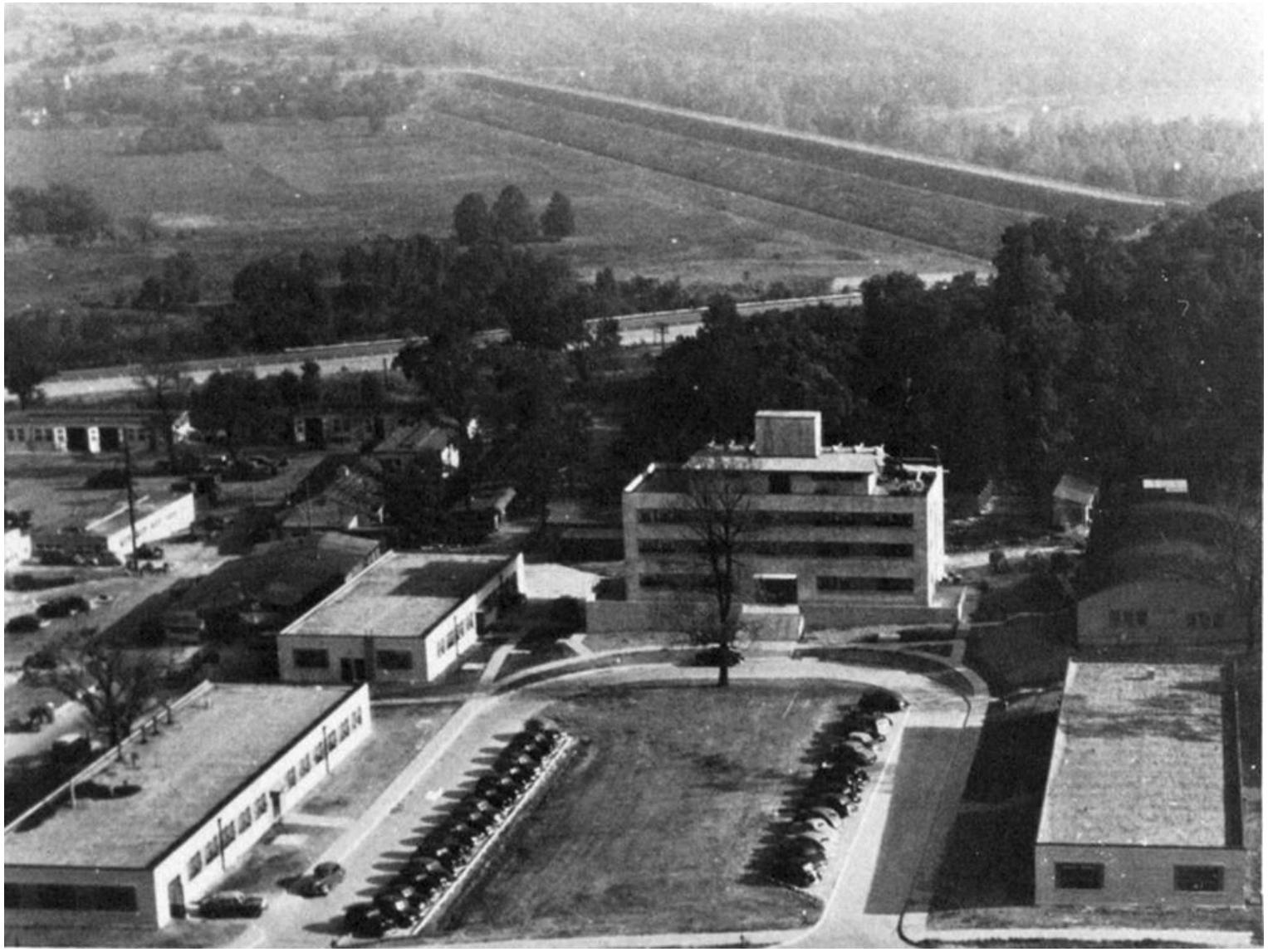
Neck Injury
Ejection-Windblast
Whole Body Impact





Fatigue Countermeasures

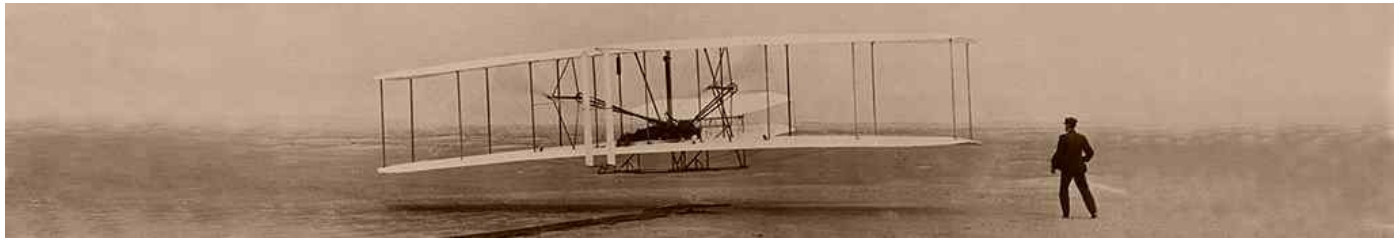
The HUB of Human Factors circa 1944



Human Effectiveness Primary Research Sites

Our Legacy and Future

Yesterday



Today

Tomorrow